Turning the power grid into an extremely large space science instrument

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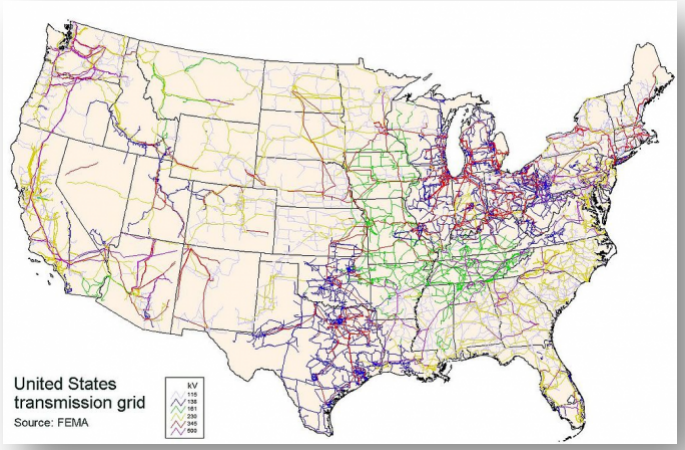


The US transmission system that will be used as an antenna for space physical remote sensing

Example of transformer damaged due to GIC

Geomagnetically induced currents (GIC) that flow in power grids during space weather storms can be a hazard for reliable transmission of electricity. GSFC's space weather team has developed new technology that not only provides real-time information for mitigation of the hazard but also allows the grid to serve as a space physical antenna. The work is being conducted with the US transmission industry's support.

- The system will allow the extraction of information about continental scale geoelectric fields and ionospheric-magnetospheric electric currents. These will be used to build unprecedented spatiotemporal picture of the geological conditions and near-space physical phenomena.

- Power system operators can use the real-time data for situational awareness about GICs. Real-time GIC information can be used to assist mitigation actions power companies may take.

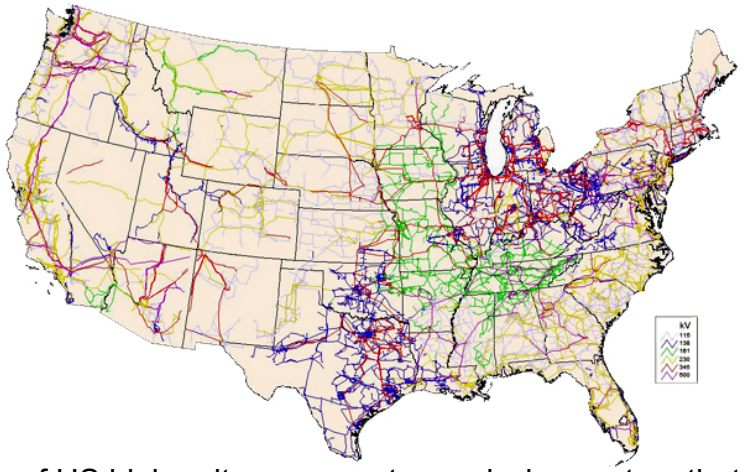
*Game Changing Usage of High-Voltage Power Transmission Systems as Extremely Large ANTENNAs for Space Physical and Geophysical Remote Imaging

Description and Objectives:

- We have started using the US high-voltage power transmission system as an extremely large antenna for geophysical and space physical remote sensing.
- The implemented technology will also provide real-time information about space weather impacts to the power transmission industry .

Key challenge(s)/Innovation:

- The team has developed low-cost fluxgate magnetometer sensor stations that can be deployed in large numbers.
- The team also developed new methods that are used to convert observed raw induced currents data into geophysical and space physical information.



Map of US high-voltage power transmission system that will be used as a scientific instrument

Approach:

- The team developed in the pilot phase three sensor stations and mathematical theory for the analyses.
- The pilot stations have all the capabilities required for the ultimate large-scale implementation of the concept.

Application / Mission:

- The new technology will be used for space physical and geophysical remote sensing.
- The new technology will be used for mitigating space weather effects on the high-voltage power transmission systems.

Collaborators:

- The team has been collaborating in the pilot phase with the Dominion Virginia Power. The pilot system will be implemented in the Dominion network.

Milestones and Schedule:

- Development of data analysis tools including the new inversion method: December, 2013.
- Completed building of prototype magnetometer stations: September, 2014.
- Secured new significant industry partners for the follow-up work: June 2014.

Space Technology Roadmap Mapping:

- Primary Technical Area: TA08.
- Secondary Technical Area: TA11.
- Applicable Space Technology Grand Challenge: New Tools of Discovery.

Technology Readiness Level:

- Starting TRL: 1.
- Ending TRL: 5.